Marked-Up Version of Substitute Specification

~~Description~~

~~POWER CONTROL FOR A MOBILE RADIO COMMUNICATION SYSTEM~~

SPECIFICATION

TITLE

POWER CONTROL FOR A MOBILE RADIO COMMUNICATION SYSTEM

FIELD OF TECHNOLOGY

~~This invention~~ The present disclosure relates to a communications system, particularly to a Universal Mobile Telecommunications System (UMTS), a method for transmitting data in a communications system, and a base station system.

BACKGROUND

~~The transmitted~~ Transmitted data at ~~the~~ a base station of a 3GPP W-CDMA (FDD) cellular radio system can be divided into time continuous traffic (DCH, CCH) and burst like control data, ~~which is in particular~~ that includes the synchronization channel (SCH) [2]. The SCH is time multiplexed with the primary common control physical channel (P-CCPCH). Traditional network configuration assumes equal power (transmit power) for SCH and P-CCPCH such that the sum power level (also denoted as "total transmit power of the used channels") is constant over time. This situation is illustrated in figure 1. "BS- Power" means the transmit power at the base station. ~~Please note~~ It is further noted that the CDMA system capacity is limited by its self interference, which is ~~in particular~~ particularly caused by all non desired users and the control channels. Thus the capacity is given by the ratio of area of the DCH block divided by the total area in figure 1. The sum transmit power of the dedicated downlink channels (also denoted as "transmit power of dedicated channels", "total , transmit power of the dedicated downlink channels") is regularly constant within one time slot.

Currently, it is a standard requirement that also the DCH-power of each traffic channel is either constant during the whole slot (time slot) or may change with fixed power steps at more or less random time instances within the slot. These instances are random in time because of the many different DCH slot formats and

the additional timing offset for each DCH relative to the SCH [2]. This is also illustrated in figure 1.

In the context of "identification of a new cell", it has been ~~recognised~~ recognized that an increased power level for the SCH compared to the P-CCPCH is necessary. This is meanwhile reflected in a respective change of standard requirements (see [3], [4]).

Figure 1 and figure 2 show a dashed line, which represents ~~the~~ a maximum power amplifier (PA) level at the base station (BS) (also denoted as "amplifier power limit", "maximum power limit"). This level is ~~an important~~ a meaningful design parameter of a base station since it has significant impact on cost, size and power consumption of the whole base station.

Currently the 3GPP standard allows an increase of the SCH power only in a way as depicted in figure 2. A discontinuity of the transmitted power (also denoted as "total transmit power of the used channels", "total output power at the base station power amplifier", "sum power") over time is introduced. Two power budged options are shown in figure 2:

Option one on the left hand side keeps the sum power always below the "amplifier power limit". The spectral distortion of the BS transmit signal due to discontinuity can be neglected. The system capacity, however, is considerably reduced, because the total DCH-power (area of the DCH block) compared to the sum power is reduced.

Option two on the right hand side of figure 2 exploits the full mean power the base station (sum area of all channels corresponds to "maximum mean power") and the capacity loss is relatively low . The peak power, however, is increased and due to the non-linearity of the BS power amplifier, spectral distortion of the transmit signal occurs.

The change of requirements, which demands for increased SCH-level, is quite new. Based on the current W-CDMA standard known solutions are shown in figure 2. This means either considerable system capacity loss or more expensive, larger and less efficient power amplifier.

SUMMARY

Based on the foregoing ~~description it is an object of the invention to provide~~ description, a communications system, a method for transmitting data and a base station system is disclosed for enabling, that enable a reliable synchronisation in a communications system.

~~The object of the invention will be achieved with a communications system, a method for transmitting data and a base station system, which are defined by what is disclosed in the appended independent claims. Advantageous embodiments of the present invention will be presented in the dependent claims. Further developments of the method claim and the base station system claim corresponding to the dependent claims of the communications system claim also lie within the scope of the invention.~~

~~The~~ Under the disclosed exemplary embodiment, the reduction of the transmit power of the dedicated channels can be different for different dedicated channels, particularly in dependence on the different quality of service requirements assigned to the dedicated channels.

Each dedicated channel can be related to one mobile station. Some dedicated channels can be related to the same mobile station.

Each common channel can be related to at least two mobile stations.

Of course it lies also within the scope of this invention to execute the invention only within certain parts or base station systems of a communications system or within certain predefined time intervals.

Preferably the plurality of common channels .(P-CCPCH, CCH) under the embodiment ~~including~~ include a primary common control physical channel (P-CCPCH) and/or ~~the~~a plurality of dedicated channels (DCH) and/or ~~the~~a synchronisation channel (SCH), and are ~~realised~~ realized by a ~~certain~~ specific base station or base station ~~system and the~~ system. The transmit power of dedicated channels (DCH) ~~being~~ is reduced during the transmission of the synchronisation channel (SCH) ~~is~~ and the total transmit power of the dedicated downlink channels are ~~realised~~ realized by this base station or base station system.

~~Of course it lies within the scope of this invention, that~~ Furthermore, other common channels or dedicated channels within the communications system ~~are~~may

be ~~realised~~ realized by other base stations or base station systems. One~~, more or all~~ or more of these base stations or base stations systems can also be arranged such, that the transmit power of dedicated channels (DCH) being reduced during the transmission of a synchronisation channel (SCH) by one of these base stations or base station systems is the total transmit power of the dedicated downlink channels realised by this base station or base station system.

~~One special idea underlying an embodiment of the invention is to keep~~ One result of this configuration is that the sum power over all physical channels are kept at a constant level, and ~~to decrease~~ the DCH power is decreased during SCH-transmission ~~for that purpose~~.

~~Advantages~~ Another advantage gained by the traffic channel cutback (DCH power reduction during SCH transmission) ~~are:~~are that the cutback ~~Traffic channel cut back (DCH power reduction during SCH transmission)~~ during SCH transmission balances the sum power along the slot. This improves the spectral behaviour of the (power limited) amplifier and makes the power amplifier cheaper, smaller and more efficient. The system capacity degradation is relatively low since the total power assigned to DCH-traffic is high.

BRIEF DESCRIPTION OF THE DRAWINGS

~~In the following, the invention will be described by means of preferred embodiments with reference to the accompanying drawings, in which:~~ The various objects, advantages and novel features of the present disclosure will be more readily apprehended from the following Detailed Description when read in conjunction with the enclosed drawings, in which:

Figure 1 ~~shows traditional~~ illustrates a conventional power budget of W-CDMA physical channels at the base station ~~(prior art)~~;

Figure 2 ~~shows~~ illustrates a conventional power distribution of W-CDMA physical channels at the base station to cope with new requirement for cell ~~(prior art)~~; and

Figure 3 ~~shows~~ illustrates a schematic view of a reduction of the DCH transmit power ("Traffic Channel Cutback"), under an exemplary embodiment.

DETAILED DESCRIPTION

The graph in figure 3 shows the transmit power (BS power) of the transmit amplifier of a base station over time.

The power of a plurality of common channels (P-CCPCH, CCH) including a primary common control physical channel (P-CCPCH) is shown as well as the sum transmit power of the dedicated downlink channels (also denoted as "transmit power of dedicated channels") (DCH). ~~Particularly~~ Preferably these channels are realised by one base station.

The transmit power of the synchronisation channel (SCH) in Figure 3 exceeds the transmit power of the primary common control physical channel (P-CCPCH), that is transmitted time multiplexed with the synchronisation channel (SCH).

The sum transmit power of the dedicated downlink channels (also denoted as "transmit power of dedicated channels") (DCH) is reduced during the transmission of the synchronisation channel (SCH).

The communications system is a Wide-Band-CDMA-System (W-CDMA) in particular a Universal Mobile Telecommunications System (UMTS), and the common channels and the dedicated channels are transmitted code multiplexed.

The reduction of the transmit power of dedicated channels (DCH) is such that the total transmit power of the used channels (total output power at the base station power amplifier) is not above an amplifier power limit and preferably remains substantially constant.

The transmit power of the dedicated channels is reduced during the transmission of the synchronisation channel (SCH) by the difference between the transmit power of the synchronisation channel (SCH) and the transmit power of the primary common control physical channel (P-CCPCH).

The transmit power of dedicated channels (DCH) is reduced at the beginning of the synchronisation channel (SCH), and the transmit power of dedicated channels (DCH) is increased at the end of the synchronisation channel (SCH).

The reduction of the transmit power of dedicated channels (DCH) during the transmission of the synchronisation channel (SCH) is triggered in dependence

on information about the synchronisation channel timing. This information is preferably stored in a memory unit of or assigned to the base station system.

The reduction of the transmit power of dedicated channels is such that the total transmit power of the used channels is substantially constant and not above an amplifier power limit (1) just before the transmission of the synchronisation channel, (2) just after the transmission of the synchronisation channel and (3) during the transmission of the synchronisation channel.

~~It lies also within the scope of this invention to change the~~ The total transmit power of the used channels may also be changed later ~~for example~~ due to lower traffic demands.

The sum transmit power of the downlink dedicated channels (DCH) is reduced during the transmission of the synchronisation channel (SCH) ~~particularly~~ in order to keep the total output power at the base station power amplifier below a maximum power limit.

With regard to figure 3 it should be noted, that the signal level reduction occurs asynchronously to the DCH slot and field boundaries.

~~There are the following different alternatives and modifications of the basic idea, which lie also within the scope of this invention:~~Other embodiments may be derived from the present disclosure without deviating from the teachings disclosed herein. These embodiments incoude:

• Switching between a fully loaded and a partially loaded system: DCH power truncation (DCH power reduction during SCH transmission) is turned off in case of ~~an only~~ a partially loaded system~~:~~. The spectral degradation due to sum power bursts (SCH) are not critical and individual link quality can be kept optimum instead.

• Selective reduction of DCH level during SCH transmission based on service specific quality requirements or certain DCH-fields.

A communications system for ~~realising~~ realizing the ~~invention shows~~ present disclosure includes one or more base station systems that are connected with each other and/or with other communications systems via one or more mobile switching ~~centres~~ centers. Data ~~are~~ is transmitted via downlink channels from the

base station system to mobile stations and via uplink channels from mobile stations to the base station system. Thus a communication between mobile stations is enabled. The base station systems show a processing unit that is arranged such, that the primary common control physical channel (P-CCPCH) and the synchronisation channel (SCH) are transmitted time multiplexed, and that the transmit power of dedicated channels (DCH) is reduced during the transmission of the synchronisation channel (SCH).

It should be understood that the various changes and modifications to the presently preferred embodiments described herein will be apparent to those skilled in the art. Such changes and modifications can be made without departing from the spirit and scope of the present disclosure and without diminishing its intended advantages. It is therefore intended that such changes and modifications be covered by the appended claims.

References:

[1] 3GPP TS25.101 V3.13.0 (2003-03): UE Radio Transmission and Reception (FDD)

[2] 3GPP TS25.211 V3.12.0 (2002-09): Physical channels 5 and mapping of transport channels onto physical channels (FDD)

[3] 3GPP TS25.133 V3.13.0 (2003-03): Requirements for Support of Radio Resource Management (FDD)

[4] TSG-RAN WG4#25, R4-021580: On Cell Identification in Multi-Path Fading Conditions.

ABSTRACT

A communication system ~~is described, the communication system comprising:~~ having a plurality of common channels ~~(P-CCPCH, CH) including~~ and includes a primary common control physical channel ~~(P-CCPCH)~~, a plurality of dedicated channels and ~~(DCH)~~ a synchronization channel (SCH)~~, the~~ . The primary common control physical channel ~~(P-CCPCH)~~ and the synchronization channel ~~(SCH) being~~ are transmitted time multiplexed, and the sum transmit power of dedicated channels ~~(DCH) being~~ is reduced during the transmission of the synchronization channel ~~(SCH)~~ in order to keep the total output power at the base station power amplifier below a maximum power limit.